APPENDIX F

THREAT COUNTERPART SYSTEMS

Recent years have seen rapid and revolutionary changes in the field of armor and antiarmor warfare. The most radical changes have been in the design of armor itself, the fire control systems (especially in thermal sights), the warheads and kill mechanisms of the missiles, and the various countermeasures that have been developed. The rate of change is increasing, and antiarmor crewmen and trainers must make a continual effort to keep abreast of recent developments. What was true one year ago, or even two years ago, is not necessarily true today. Leaders who take their men into battle and make decisions based on outmoded information and assumptions are dooming those men to failure and death.

F-1. THREAT ARMORED VEHICLES

Armored vehicle identification in the past was a simple matter of distinguishing between vehicles manufactured by Warsaw Pact nations and those manufactured by NATO nations. Even then, many soldiers had difficulty distinguishing between vehicles on a simple "friend or foe" basis. Changes in international relations have made it less likely that we will meet the Warsaw Pact in battle, but more likely that we will meet a third world nation's troops. From the standpoint of vehicle identification, this greatly complicates the problem. Most third world nations do not manufacture their own vehicles, but buy them from other countries. As a result, many of them have vehicles from nearly every manufacturing nation in the world in their inventories. Twenty nations in the world today have more than 500 main battle tanks each. Two possible examples of many illustrate this point (Table F-1, page F-2).

a. The task of armored vehicle identification has become much more complex. The antiarmor crewman must now become familiar with a much wider variety of vehicles than before. He must also be well informed about what vehicles a potential enemy possesses.

b. This manual is not a complete FM on vehicle identification. However, the antiarmor crewman should be readily familiar with a few of the most recently fielded vehicles and the particular problems and capabilities they present.

COUNTRY	TYPE	ORIGIN
Iran	Type 59	China
	Type 69	China
	Chieftain	United Kingdom
	M48A5	USA
	M60A1	USA
	T62	Russia
	T72	Russia
	EE-9 Cascavel	Brazil
	M113	USA
Iraq	Type 59	China
	AMX-30	France
	Chieftain	United Kingdom
	T62	Russia
	T72	Russia
	EE-11 Urutu	Brazil
	Walid	Egypt
	MOWAG Roland	Switzerland
	M113A1	USA

Table F-1. Tank types and places of origin.

(1) *BMP-2* (Figure F-l). The BMP-2 is similar to the BMP-1, but with a major armament change from the 73-mm smoothbore of the BMP-1 to a 30-mm dual-purpose automatic cannon. The 30-mm gun has an effective range of from 2,000 to 3,000 meters, depending on the type of ammunition used, and 3,000 meters against subsonic aircraft and helicopters. Some BMP-2s have been seen with additional panels of applique armor mounted on the turret.

(2) *T-64B* (Figure F-2). The T-64B is similar in appearance to the T-64/64A. It has full length track skirts, only 8 smoke projectors, and the optic on the left side of the turret is twice the size of that on the T-64A. Significant differences are that it has a laser range finder, sometimes mounts reactive armor, has applique armor on the turret roof and sides and part of the hull roof, and fires the AT-8 Songster ATGM through the gun barrel.

(3) *T-72M1* (Figure F-3). The T-72M1 is an improved version of the basic T-72. Visual differences include full track skirts, smoke grenade launchers, and no right-hand optic. Significant differences include a probable laser range finder, thicker upper glacis, thicker frontal turret armor, applique armor on the turret roof, and provisions for mounting reactive armor. Overall,

its offensive capabilities are similar to the basic T-72, but it is much better protected. This tank has been nicknamed the "Super Dolly Parton" in the west.

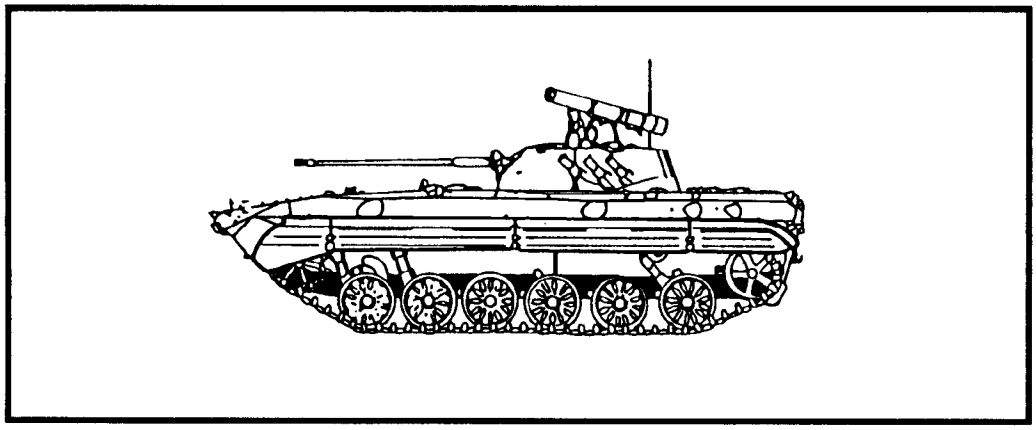

Figure F-1. BMP-2.

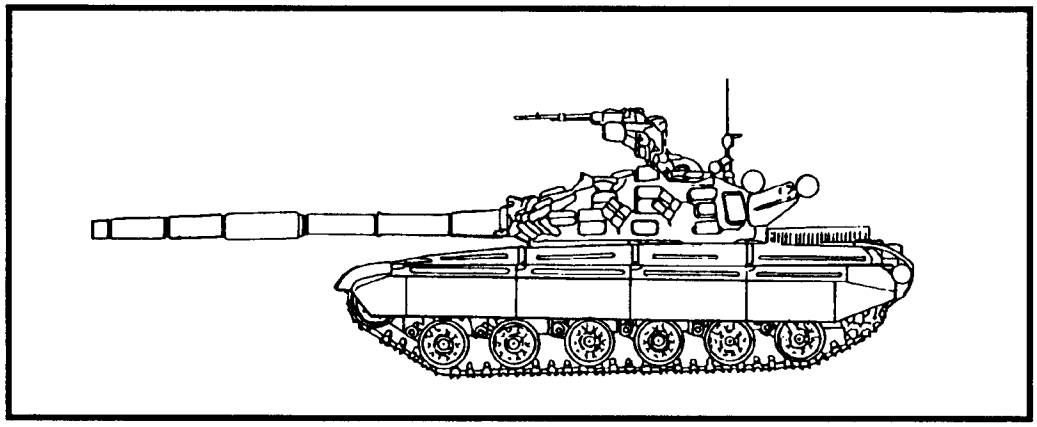

Figure F-2. T-64B.

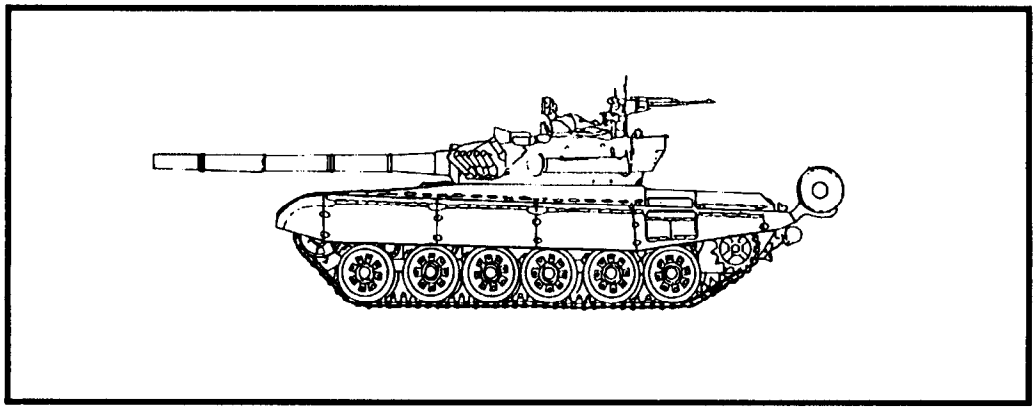

Figure F-3. T-72M1.

(4) *T-80* (Figure F-4). The most recent series-produced Russian tank, the T-80 has some features of both the T-64 and T-72, and other features unique to itself. Visual keys are rubber-tired road wheels, a self-entrenching blade on the lower glacis, a large left-hand optic, and smoke grenade launchers on the rear of the turret sides. Significant differences are the ability to fire the AT-8 Songster through the gun barrel (like the T-64B), improved mobility through a 1,000 horsepower turbine engine, a probable laser range finder, and probable enhanced armor on the glacis and turret (an upper glacis of steel layers enclosing fiberglass layers and a cast steel turret enclosing nonmetallic materials). In general, the offensive capabilities of the T-80 are similar to the T-64B, but it is faster and better protected.

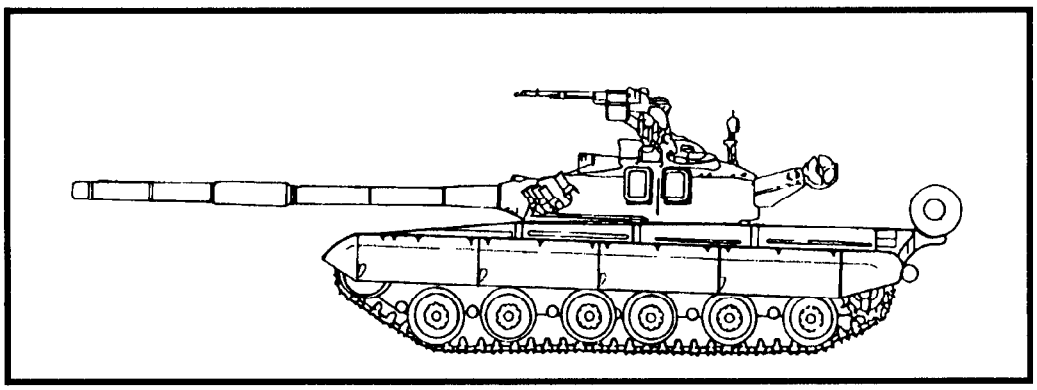

Figure F-4. T-80.

F-2. THREAT INFANTRY ANTIARMOR WEAPONS

The principal threat infantry antiarmor weapons areas follows:

a. **AT-2 Swatter** (Figure F-5). Three types: A, B, and C.
Minimum range — 500 meters (A, B), Unknown (C).
Maximum range — 2,500 meters (A), 3,500 meters (B), 4,000 meters (C).
Warhead — HEAT.
Armor pen — 500+ millimeters.
Guidance — MCLOS (A, B), SACLOS (C).
Command — Radio.
Platforms — BRDM, Mi-8, Mi-24.

b. **AT-3 Sagger** (Figure F-6).
Minimum range — 500 meters.
Maximum range — 3,000 meters.
Warhead — HEAT.
Armor pen — 400+ millimeters.
Guidance — MCLOS.
Command — Wire.
Platforms — Manpack, BRDM, Mi-2, Mi-8TB.

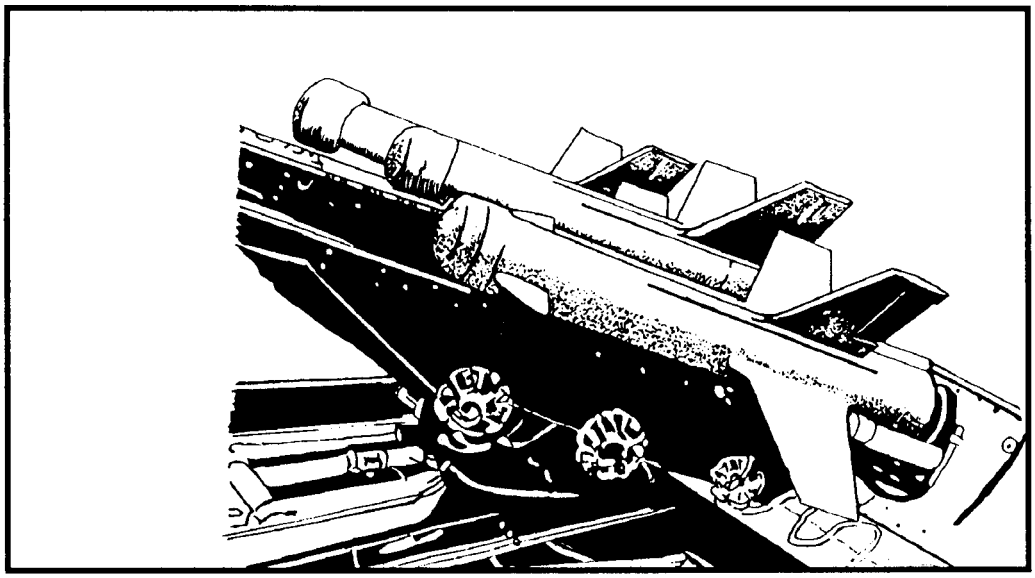

Figure F-5. AT-2 Swatter.

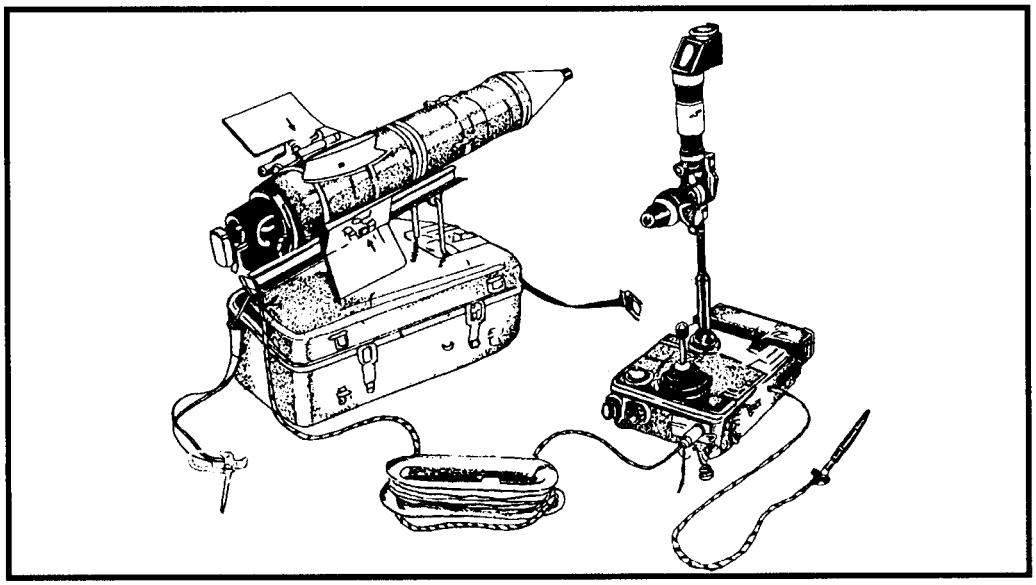

Figure F-6. AT-3 Sagger/manpack.

c. **AT-4 Spigot** (Figure F-7, page F-6).
Minimum range — 70 meters.
Maximum range — 2,000 meters.
Warhead — HEAT.
Armor pen — 500 to 600 millimeters.
Guidance — SACLOS.
Command — Wire.
Platforms — Manpack, BMP, BMD.

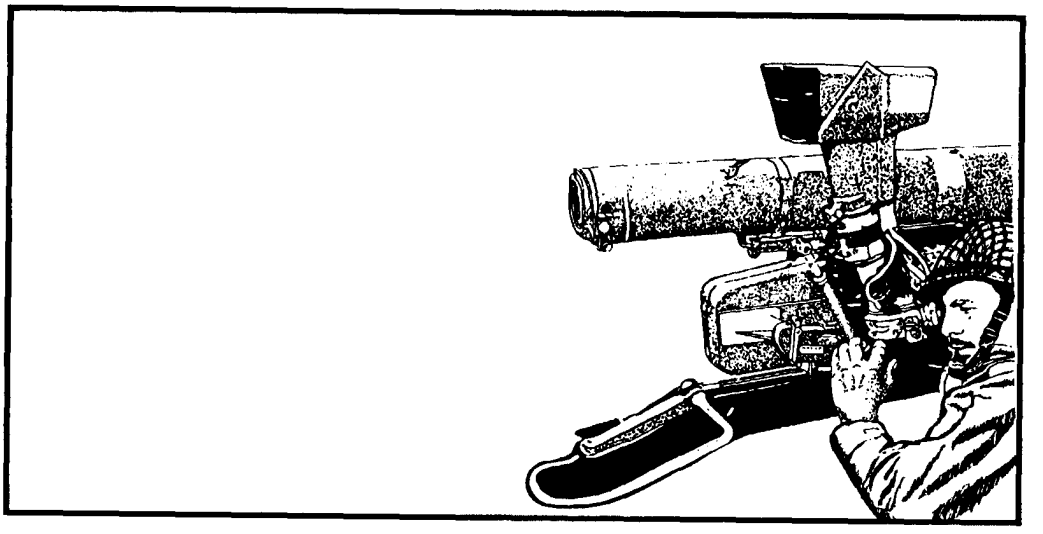

Figure F-7 AT-4 Spigot.

d. **AT-5 Spandrel** (Figure F-8).
Minimum range — 100 meters.
Maximum range — 4,000 meters.
Warhead — HEAT.
Armor pen — 500 to 600 millimeters.
Guidance — SACLOS.
Command — Wire.
Platforms — BRDM, BMP.

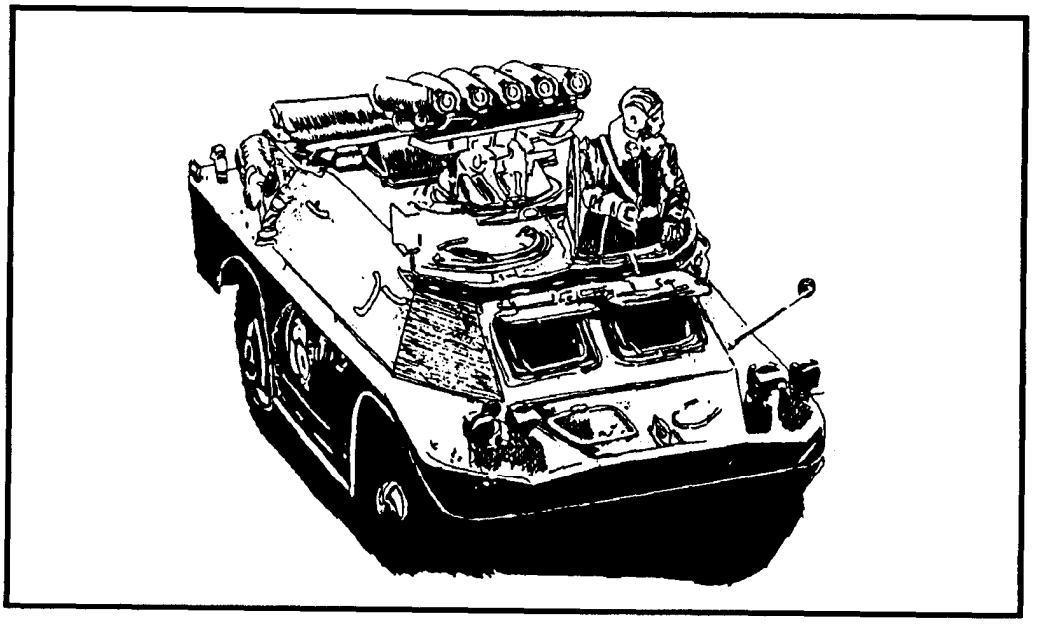

Figure F-8. AT-5 Spandrel.

e. **AT-6 Spiral** (Figure F-9).
Minimum range — 500 meters.
Maximum range — 5,000 meters.
Warhead — HEAT.
Armor pen — 600 to 700 millimeters.
Guidance — SACLOS.
Command — Radio.
Platforms — Mi-24.

Figure F-9. AT-6 Spiral.

f. **AT-7 Saxhorn** (Figure F-10, page F-8).
Minimum range — Unknown.
Maximum range — 1,000 meters.
Warhead — HEAT.
Armor pen — Unknown.
Guidance — SACLOS.
Command — Wire.
Platforms — Manpack.

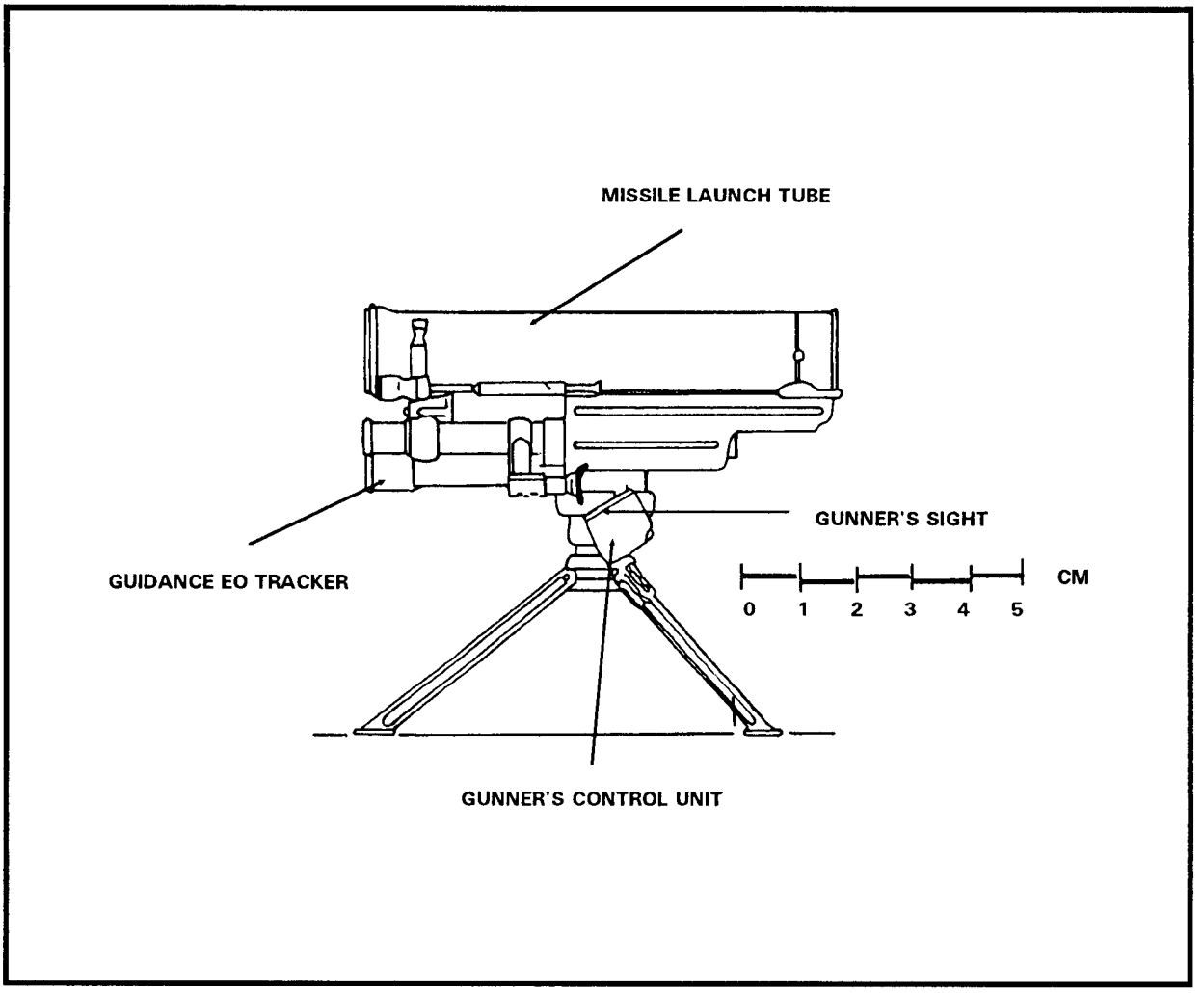

Figure F-10. AT-7 Saxhorn.

g. AT-8 Songster (Figure F-11). This missile is one of the newest ATGMs in the Russian inventory and represents a particular threat to TOW crews, especially ITVs. The missile is fired through the main gun tube of a T-64B or T-80, but uses a boost/sustain motor to propel it to the target. The missile has a 4,000-meter range and is supersonic, giving it a short flight time. Its principal role is antitank, but it can also be used against helicopters.

Minimum range — Unknown.
Maximum range — 4,000 meters.
Warhead — HEAT.
Armor pen — 700 to 800 millimeters.
Guidance — SACLOS.
Command — Radio.
Platforms — T-64B, T-80.

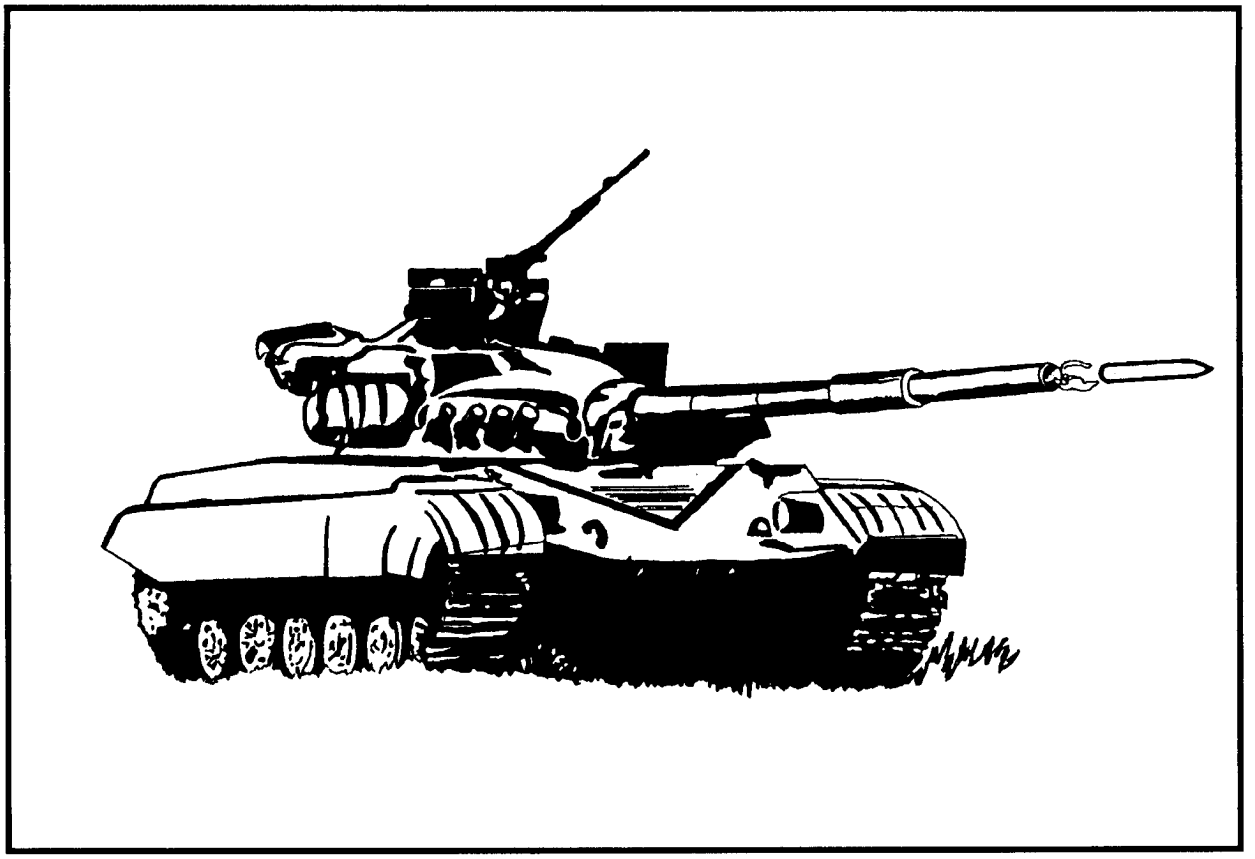

Figure F-11. AT-8 Songster.

F-3. THREAT INFANTRY ARMOR COUNTERMEASURES

For nearly 20 years the use of large numbers of ATGMs in infantry formations has been a keystone of U.S. Army antitank defenses. In particular, the deployment of thick belts of ATGMs has been the foundation of NATO's plans for the defense of Europe against the Warsaw Pact nations. The Russian Army has developed a number of potential countermeasures. The use of these countermeasures is not restricted to Warsaw Pact troops. They may be employed by any enemy we may face.

a. **Reconnaissance.** A high priority for Russian reconnaissance elements is to locate enemy ATGM sites before the main body enters their kill zone. Methods of reconnaissance can include aircraft, drones, signals intelligence, and conventional ground reconnaissance elements. Russian commanders expect to get 75 to 95 percent of their intelligence before the attack. Leaders must learn to emphasize careful camouflage and concealment and to conduct effective counterreconnaissance operations. Lessons learned at NTC show that the commander who loses the counterreconnaissance phase of the battle loses the battle. For Russian reconnaissance to be effective, the reconnaissance elements must spot your weapon systems and survive to report their location.

b. **Artillery.** Once Russian reconnaissance elements have spotted ATGM positions, the weapon of choice to destroy them is artillery. Since ATGMs area high-priority target for them, these positions will be subjected to intense barrages. The TOW is not designed to withstand such barrages. The best way to survive is to remain undetected and to avoid terrain that is likely to attract heavy artillery fire. Positions should be as well protected against artillery as possible. Move, if possible, when positions come under artillery fire.

c. **Helicopters.** Attack helicopters routinely follow artillery preparation. Again, ATGMs are high-priority targets. Russian attack helicopters will engage surviving ATGM positions with 57-mm rockets or its own ATGMs. Depending on the ATGM the helicopter is equipped with, it may be able to engage at up to 5,000 meters.

d. **Direct Fire.** Over half of the ammunition on a Russian tank is HE-FRAG. This ammunition is expressly designed to suppress ATGMs and fighting positions. Also, the T64B and T80 carry the AT-8 Songster, a supersonic missile with a 4,000-meter range. The primary role of this missile is believed to be destruction of antiarmor systems such as the Bradley, ITV, and attack helicopters.

e. **AGS-17 Automatic Grenade Launcher.** This weapon is similar to the U.S. MK 19, but fires a 30-mm round. It has a maximum effective range of 1,730 meters. This is less than maximum range for a TOW, but in many situations, the AGS-17 will be able to get close enough to engage a TOW. This weapon is very effective against a tripod- or HMMWV-mounted TOW, and is somewhat effective against lightly armored vehicles such as the Bradley and ITV.

f. **Lasers.** Most armies use laser range finders and target designators. Many of these are quite powerful and can cause temporary or permanent damage to a gunner's eyes when he is using direct-view magnifying optics. Some of these devices can even damage the sights themselves. Thermal sights are less vulnerable to lasers.

g. **Battlefield Obscurants.** The AN/TAS-4 series of thermal sights is able to penetrate many kinds of battlefield obscurants, but not all. Bispectral smoke and battlefield dust, among others, are largely opaque to thermal sights if they are thick enough. In addition, when using a basic or ITOW, the target may be seen, but the system is unable to guide the missile through the obscurants. Soviet doctrine relies heavily on extensive use of battlefield obscurants to suppress enemy ATGM positions.

h. **Combined Arms.** Soviet doctrine prefers to fight mounted, but if they run into strong ATGM defenses, they will dismount their infantry and advance at foot pace, with the infantry engaging personnel and ATGMs. The tanks will advance first, at about 6 kph, and the infantry will closely follow the tanks. The IFVs will follow the infantry and provide supporting fire.

F-4. INFANTRY ANTITARMOR COUNTER-COUNTERMEASURES

United States forces must have counter-countermeasures against reconnaissance, artillery, helicopters, direct free, grenadelaunchers, lasers, obscurants, and combined arms.

a. **Reconnaissance.** The best counter to reconnaissance elements is effective counterreconnaissance operations by defending forces. Equally important is effective and rigidly enforced camouflage and concealment.

b. **Artillery.** The best defense against artillery is not to be discovered by the enemy's reconnaissance elements. This may not be possible, so positions must be as well prepared against heavy artillery fire as time permits. When all else fails, it may be necessary to move positions. Secondary and alternate positions should be preselected for this eventuality.

c. **Helicopters.** The best defense against helicopters is not to be spotted in the first place. TOW positions should only engage helicopters in self-defense when they are already spotted and under attack. Helicopters not engaging TOW positions should be left to regular ADA assets. (See Chapter 6 for more detailed information.)

d. **Direct Fire.** TOW squads must maximize their chances of winning engagements with tanks and IFVs by choosing positions with good cover and concealment, striving for flank shots, striving for surprise, exercising good fire control, and carefully prioritizing their targets, to ensure that targets posing the most immediate threat are engaged first. This is, in fact, precisely the type of combat the TOW was intended to engage in.

e. **AGS-17 Automatic Grenade Launcher.** TOW squads must try to choose positions where it is difficult for enemy AGS-17 teams to get in range without being detected and engaged. Where the terrain is too close to permit this, TOW squads must emplace well behind friendly infantry, and let the infantry engage the AGS-17. The MK 19 or .50 caliber machine gun, if available, should be used to engage the AGS-17.

f. **Lasers.** Protective lenses should be installed on optical devices. The protective covers or doors on these devices should be closed when protective lenses are not available. Soldiers should wear laser-proof goggles at all times. (Soldiers are vulnerable to eye damage even when not looking through sighting devices.)

g. **Battlefield Obscurants.** TOW crews should train under realistic battlefield obscurant conditions whenever possible, so that they better understand the limitations of their thermal sights. Alternate positions that view the battlefield from a different angle and that may afford a better view should be identified and prepared. The battlefield should be carefully examined and marked to give gunners a better perspective of where things are when the field becomes partially or largely obscured. Soviet smokescreens normally end about 1,000 meters from enemy positions, so gunners should be prepared to engage targets immediately once they emerge from the smokescreen.

h. **Combined Arms.** TOW positions are ill-equipped to defend themselves against dismounted infantry. To survive a properly executed combined arms attack, TOW squads should be properly integrated into a combined arms defense, overmatching dug-in infantry, IFVs, and tanks. The TOW was never intended as a stand-alone weapon system, and leaders who attempt to employ it as such guarantee their destruction.

F-5. DIRECTED-ENERGY WEAPONS

Directed-energy weapons include lasers, microwave radiation emitters, and particle beam generators. By far the most likely type that ground troops will see in combat is the laser. This can take the form of a powerful laser range finder used as a weapon or as a specially designed laser weapon. The common perception of the laser is as a science fiction weapon that can vaporize a tank with a single blast. This is far from the truth. In fact, the laser beam will normally be invisible and is generally able only to temporarily blind a soldier who is hit in the eyes with it. If the soldier is using an optical sight of some kind, the effect is magnified. More powerful lasers may cause permanent blindness, but these are rare. Some lasers are also powerful enough to damage the lenses of optical sights or the electronics of electro-optical devices (generally thermal sights and image intensifiers). (For means of defense, see paragraph F-4 of this appendix. See FM 7-91, Appendix F for a more detailed discussion.)

F-6. IMPROVED ARMOR TECHNOLOGY

In the past decade, there has been a revolution in armor technology. Research and new developments have come from Europe, the United States, the USSR, and Israel. These improvements are continuing worldwide, and the antiarmor crewman must keep up with them. These improvements are also becoming much more common in third world armies, so the antiarmor crewman must expect to meet them wherever he goes. In addition, many older tanks and other AFVs are being retrofitted with improved armor protection, so it is not just the newer vehicles we need be concerned with. These advanced armor configurations improve the vehicles' survivability against all weapons, but for the most part they are specifically designed to protect against HEAT warheads. This is a complex technical subject, and growing more so every year, but essentially these improved types of armor fall into four categories.

a. **Reactive Armor.** Originally fielded by the Israeli Army, reactive armor appeared shortly after on Soviet tanks. Reactive armor comes in several varieties, but the principle is essentially the same on all. The armor consists of blocks of explosives sandwiched between two metal plates and bolted on the outside of the vehicle. Small arms and artillery shrapnel will not set off the blocks. However, when a HEAT round strikes the block, the explosive ignites

and blows outwards. The blast and the moving steel plates disperse and deflect the jet of the HEAT warhead, dramatically reducing its ability to penetrate armor. Many countries are now fielding different versions of reactive armor. One of its advantages is that it can easily be retrofitted onto older vehicles.

b. **Laminated Armor.** Laminated armor was developed in the West, most specifically by England, the United States, and West Germany. It consists of flat layers of steel armor plate with layers of ceramics, fiberglass, or other nonmetallic materials in between. This armor is highly effective against all types of weapons, but is difficult and expensive to manufacture. Vehicles with laminated armor are characterized by flat, slab sides, such as on the Ml and Leopard II.

c. **Composite Armor.** Composite armor consists of a nonmetallic core (usually some kind of ceramic) around which the rest of the steel of the hull or, more commonly, the turret, is molded. This is much more effective than conventional steel armor against all types of weapons, but less so than laminated armor. However, it is less difficult and expensive to manufacture. Hulls made of composite armor do not have to be slab sided, like those made of laminated armor.

d. **Applique Armor.** Applique armor is essentially extra plates mounted or welded on top of the hull or turret of a vehicle. They can be made of any material, but are frequently made of ceramic or laminated materials. Like reactive armor, applique armor is an easy and cost-effective way of improving the protection of older vehicles.

F-7. COUNTERMEASURES TO IMPROVED ARMOR TECHNOLOGY

The long-term answer to improved armor technology is primarily a technical issue: improving the kill mechanisms of our missiles to defeat the improved armor.

a. Two responses to improved armor have already been fielded: the TOW 2A and the TOW 2B. Other improved kill mechanisms will be fielded as time passes.

(1) The TOW 2A has an explosive charge in the tip of the extensible probe to prematurely detonate reactive armor and minimize its effect on the penetration abilities of the missile.

(2) The TOW 2B employs a new kill mechanism. It flies about 6 or 7 feet above the line of sight and detonates above the hull or turret of the tank. When it detonates, it creates two explosively formed penetrators (EFPs), which are metallic slugs traveling at very high speeds. These EFPs strike the top of the vehicle where the armor is thinnest and there are fewer reactive armor plates.

b. TOW crews can expect to be issued a mix of TOW missile types on the battlefield, with widely varying capabilities. Gunners and leaders must be

familiar with the different missile types and their respective capabilities. The proper type of missile must be chosen for each type of target (Table F-2).

THREAT VEHICLE TYPE TARGETS	SELECTION PRIORITY			
	FIRST	SECOND	THIRD	FOURTH
Tanks with applique armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Tanks with explosive reactive armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Tanks without applique/ reactive armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Light armored personnel carriers	TOW 2	TOW 2A	TOW 2B	ITOW
Light armored wheeled vehicles.	TOW 2	TOW 2A	TOW 2B	ITOW
Antiaircraft vehicles.	TOW 2	TOW 2A	TOW 2B	ITOW
Armored vehicles in hull defilade positions.	TOW 2B	TOW 2A	TOW 2	ITOW
Bunkers/ fortifications.	TOW 2	TOW 2A	ITOW	TOW 2B

Table F-2. Missile selection priority chart.

c. TOW crews must strive harder than ever to find positions where they can engage enemy vehicles from the flank. Modern tanks with reactive armor have become increasingly difficult to kill from the front.